ISSN-0972-1622
Vol. 25 (3-4) : 40-47

Review Article

Wolff-Parkinson-White (WPW) Syndrome : Quick Clinical Diagnosis

S.K. Chutani
Heart Rhythm and Cardiovascular Consultants, New York

Introduction

WPW Syndrome refers to the presence of a congenital accessory pathway (AP) and episodes of tachyarrhythmia. The term is often used interchangeably with pre-excitation syndrome.

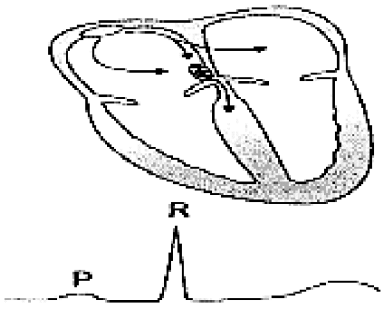
The classic description of Wolff-Parkinson-White Syndrome goes back to the original paper by the three physicians, in The American Heart Journal in 1930. They described a series of 11 patients without structural heart disease with ECG findings of a short PR interval, "bundle branch-block" and paroxysms of supraventricular tachycardia and/or atrial fibrillation.

ECG features of WPW in sinus rhythm

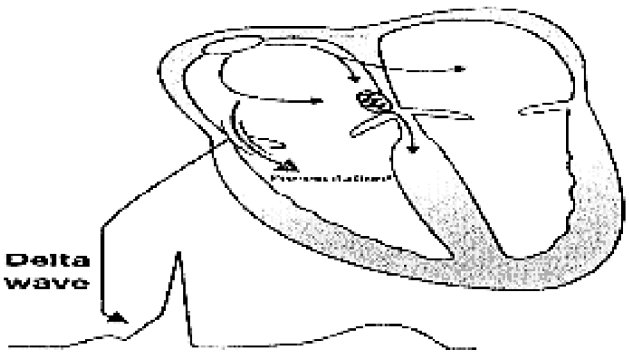
- PR interval < 120ms
- Delta wave: slurring slow rise of initial portion of the QRS
- QRS prolongation > 110ms
- Discordant ST-segment and T-wave changes (i.e. in the opposite direction to the major component of the QRS complex)
- Pseudo-infarction pattern in up to 70% of patients — due to negatively deflected delta waves in inferior/anterior leads ("pseudo-Q waves"), or prominent R waves in Vl-3 (mimicking posterior infarction)

Pathophysiology of pre-excitation and APs

Pre-excitation refers to early activation of the ventricles due to impulses bypassing the AV node via an AP. Also known as bypass tracts, APs are abnormal conduction pathways formed during cardiac development and can exist in a variety of anatomical locations and in some patients there may be multiple pathways. In WPW, the AP is sometimes referred



Normal AV transmission



Pre-excitation

Address for Correspondence :
Dr. S.K. Chutani, Heart Rhythm and Cardiovascular Consultants, New York E mail- skcepmd@live.com

to as the Bundle of Kent, or atrioventricular Bypass tract.

An example of a Right-sided AP, with anterograde conduction occurring in sinus rhythm; retrograde conduction can also occur and forms the basis of re-entry tachycardia.

An AP can conduct impulses in three ways:

1. In both directions (majority)
2. Retrograde only, away from the ventricle (15%)
3. Anterograde only, towards the ventricle (rare)

The direction of conduction affects the appearance of the ECG in sinus rhythm and during tachyarrhythmia.

APs can be left-sided or right-sided, and ECG features will vary depending on this:

1. Left-sided AP: produces a positive delta wave in all precordial leads, with R/S > 1 in Va. Sometimes referred to as a type A WPW pattern
2. Right-sided AP: produces a negative delta wave in leads Vi and V2. Sometimes referred to as a type B WPW pattern

Features of pre-excitation may be present only intermittently.

Pre-excitation may be more pronounced with increased vagal tone e.g. during Valsalva maneuvers, or with AV blockade e.g. drug therapy.

Concealed Accessory pathway

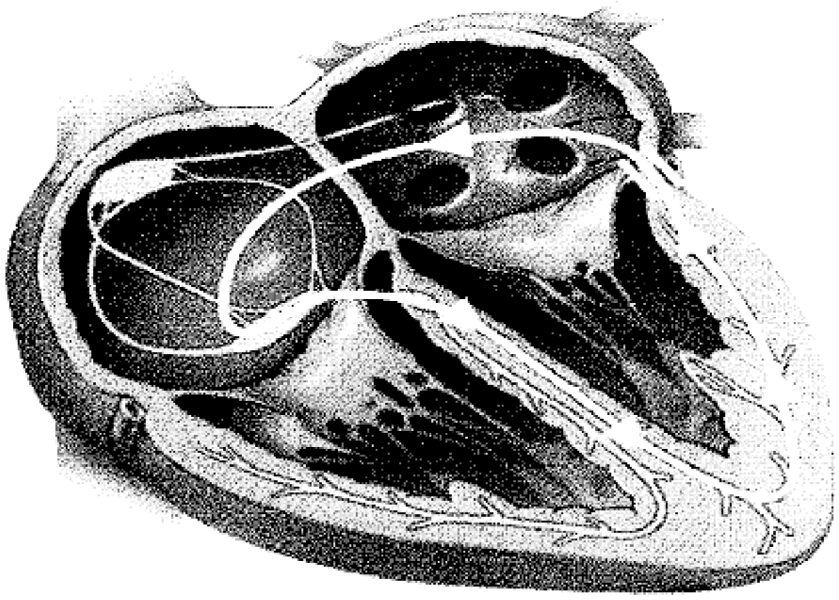
In patients with retrograde-only accessory conduction, all anterograde conduction occurs via the AV node. No pre-excitation occurs and therefore no features of WPW are seen on the ECG in sinus rhythm.

This is termed a "concealed pathway". These patients can still experience tachyarrhythmia, as the pathway can still form part of a re-entry circuit.

Arrhythmia in WPW Syndrome

There are only two main forms of tachyarrhythmia that occur in patients with WPW;

1. Atrioventricular re-entry tachycardia (AVRT). Due to formation of a re-entry circuit involving the AP with Normal ante grade conduction.
2. Atrial fibrillation or flutter. Due to direct conduction from atria to ventricles via an AP, bypassing the AV node.



Re-entry circuit during AVRT (retrograde conduction via Bundle of Kent)

Specific Pre-Excitation Syndromes / Accessory Pathways

1. Lown-Ganong-Levine (LGL) Syndrome

Proposed pre-excitation syndrome. AP composed of James fibres, No Delta wave on EKG, only short PR. The term should not be used in the absence of paroxysmal tachycardia. Its existence is disputed. ECG features:

- PR interval < 120ms
- Normal QRS morphology

2. Mahaim-Type Pre-excitation

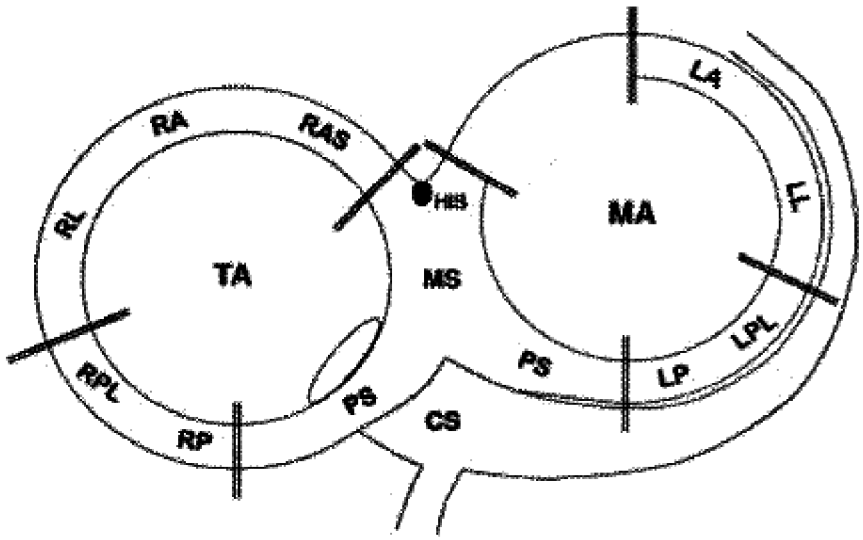
Right sided APs connecting either AV node to

ventricles, fascicles to ventricles, or atria to fascicles.
ECG features:

- Sinus rhythm ECG may be normal
- May result in variation in ventricular morphology
- Re-entry tachycardia typically has LBBB morphology

Anatomical EKG Localization of Accessory Pathways:

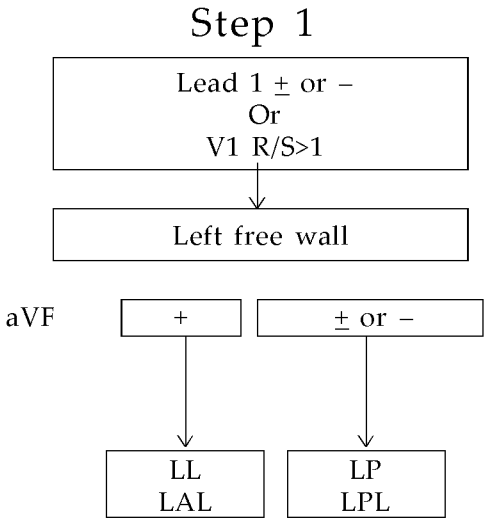
Arruda algorithm has more than 95% sensitivity and specificity. Following are the steps:



Step 1:

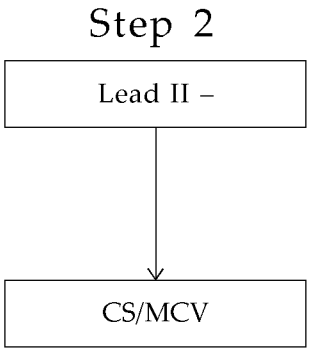
The R/S ratio in lead VI is examined. If the R/S ratio in lead VI is 0.5 or more, the AP is located in the free wall region of the mitral annulus (LA/LL or LPL/LP region). Proceed to Step 2.

If the R/S ratio in lead VI is less than 0.5, the AP is located in the free wall region of the tricuspid annulus or septum. Proceed to Step 3.



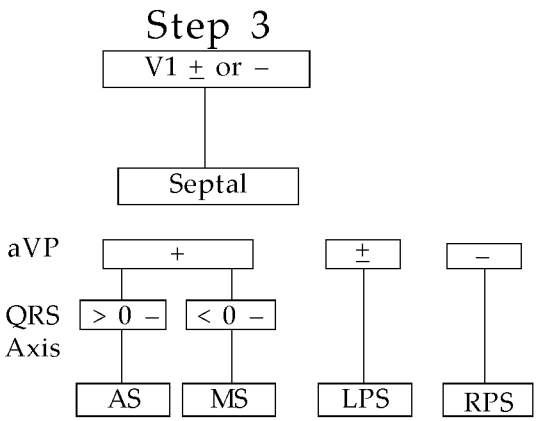
Step 2:

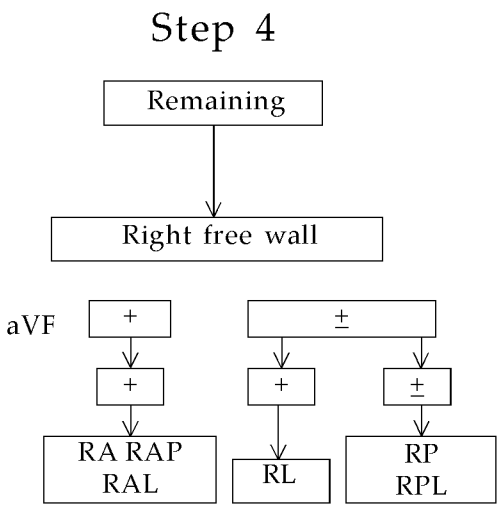
The R/S ratio in lead aVF is examined. If the R/S ratio in lead aVF is 1 or more, the AP is located in the LA/LL region. If it is less than 1, the AP is located in the LPL/LP region.



Step 3:

The R/S ratio in lead V2 is examined. If the R/S ratio in lead V2 is 0.5 or more, the AP is located in the left or right MS/PS region. If the R/S ratio in lead V2 is less than 0.5, the AP is located in the RAS/RA/RL region or the RPL/RP region. Proceed to Step 4.





Step 4:

The R/S ratio in lead aVF is examined. If the R/S ratio in lead aVF is 1 or more, the AP is located in the RAS/RA/RL region. If it is less than 1, the AP is located in the RPL/RP region.

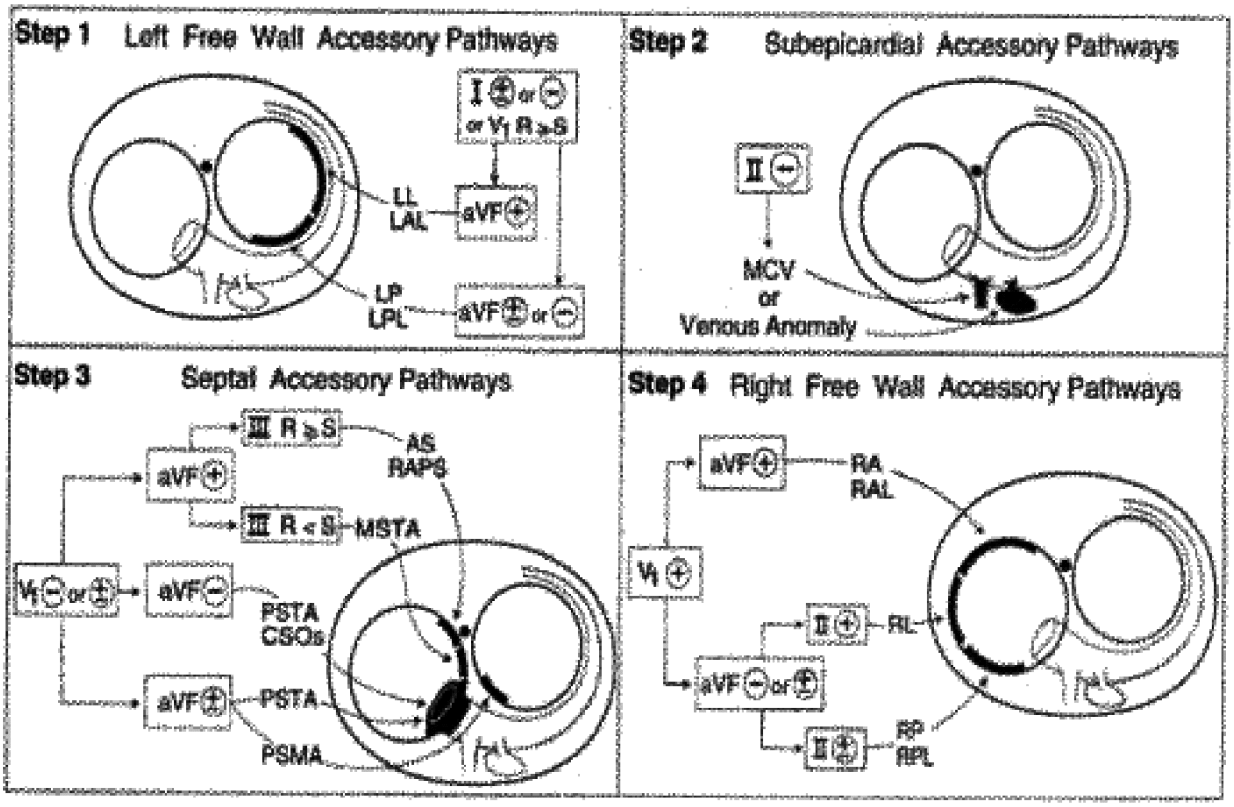
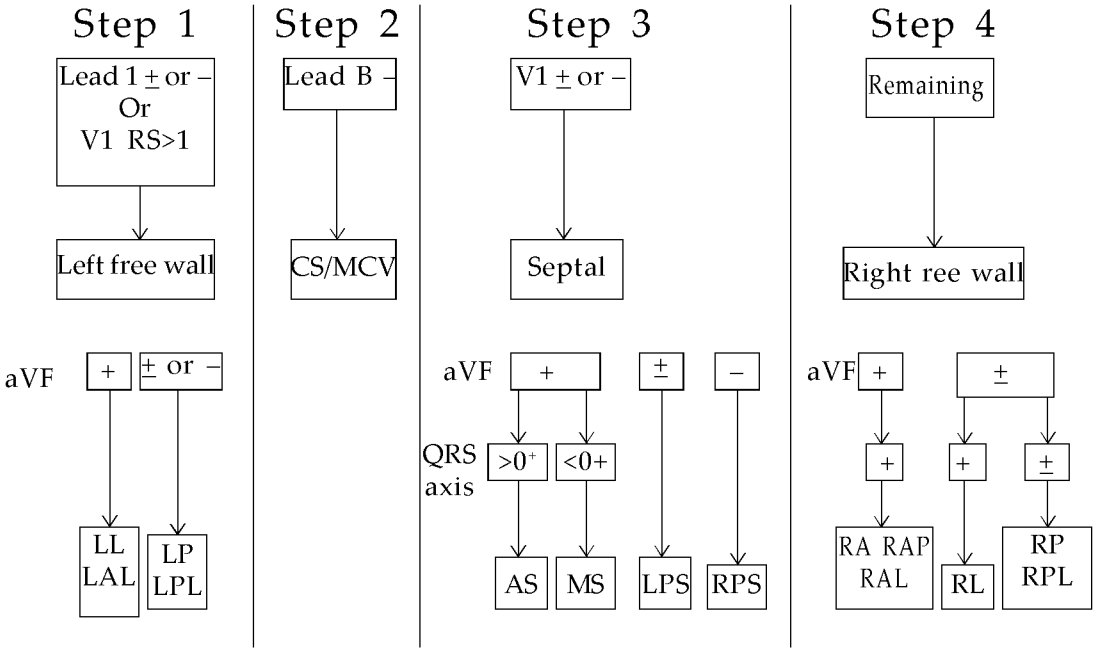
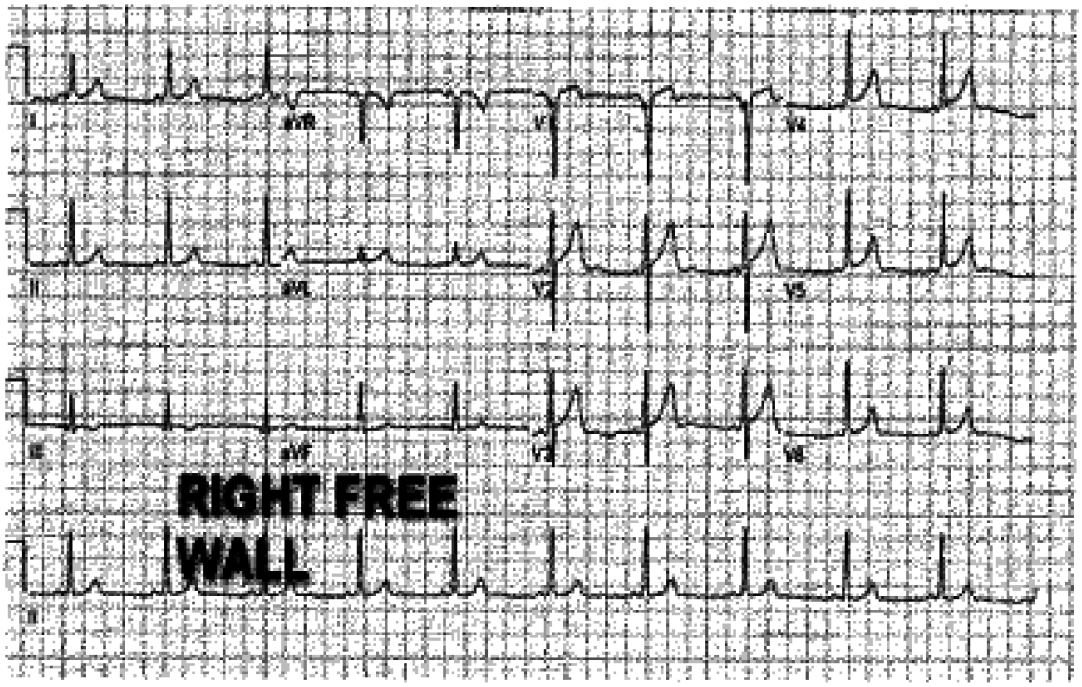


Fig: Localization of Accessory pathway

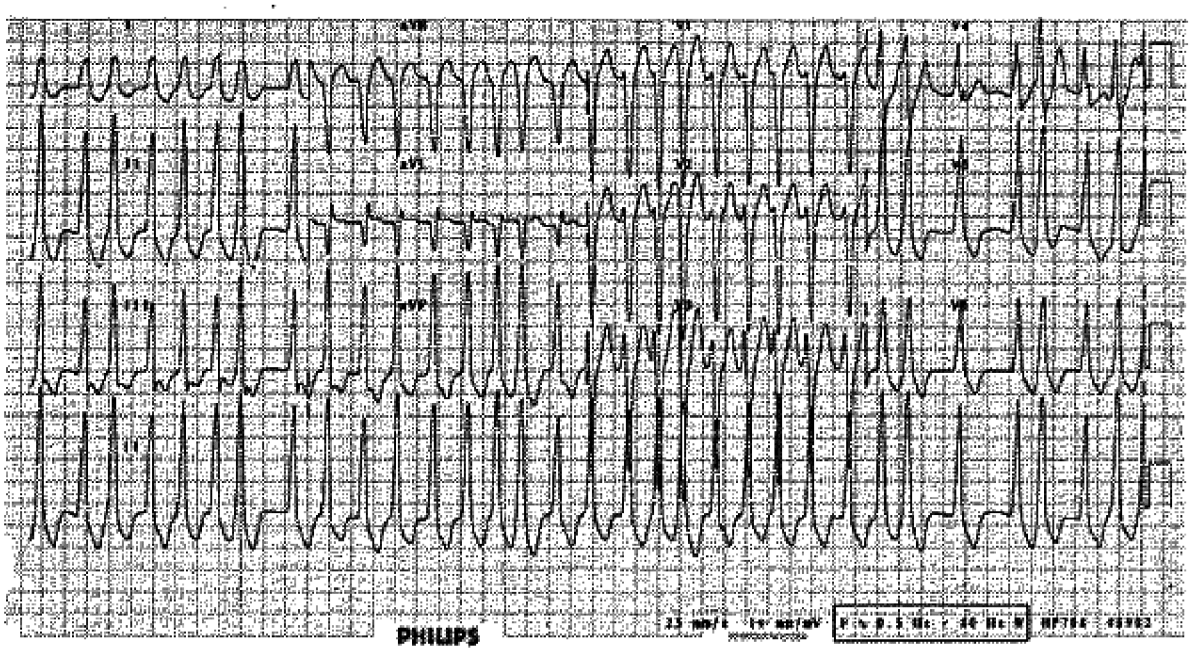
Summary of Steps



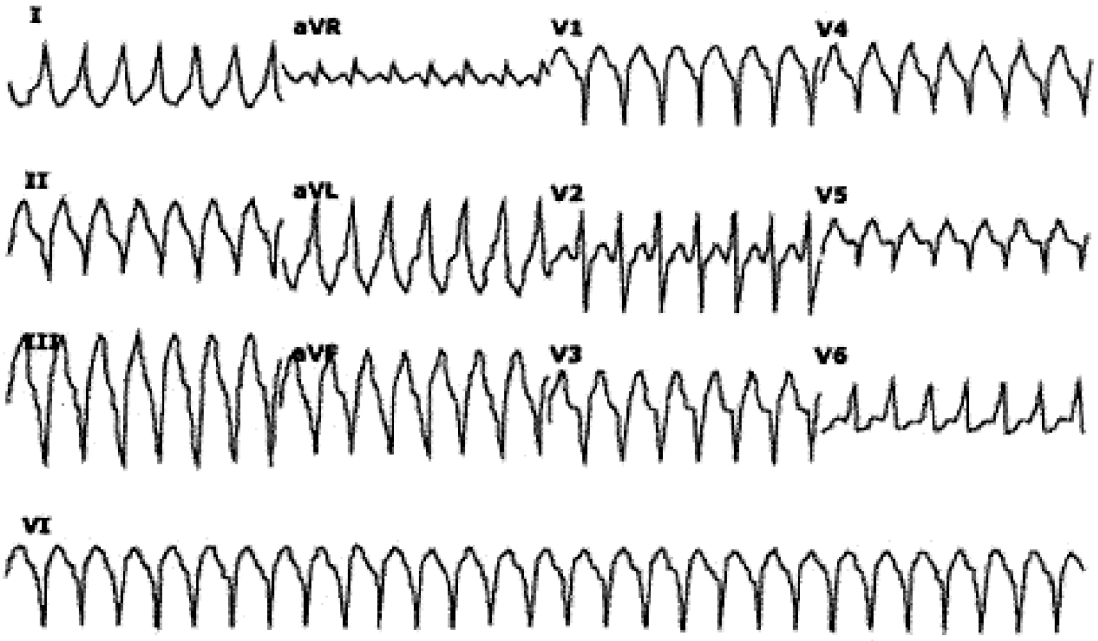
EKG Examples of Typical Accessory Pathway:



Accessory pathway and A Fib:

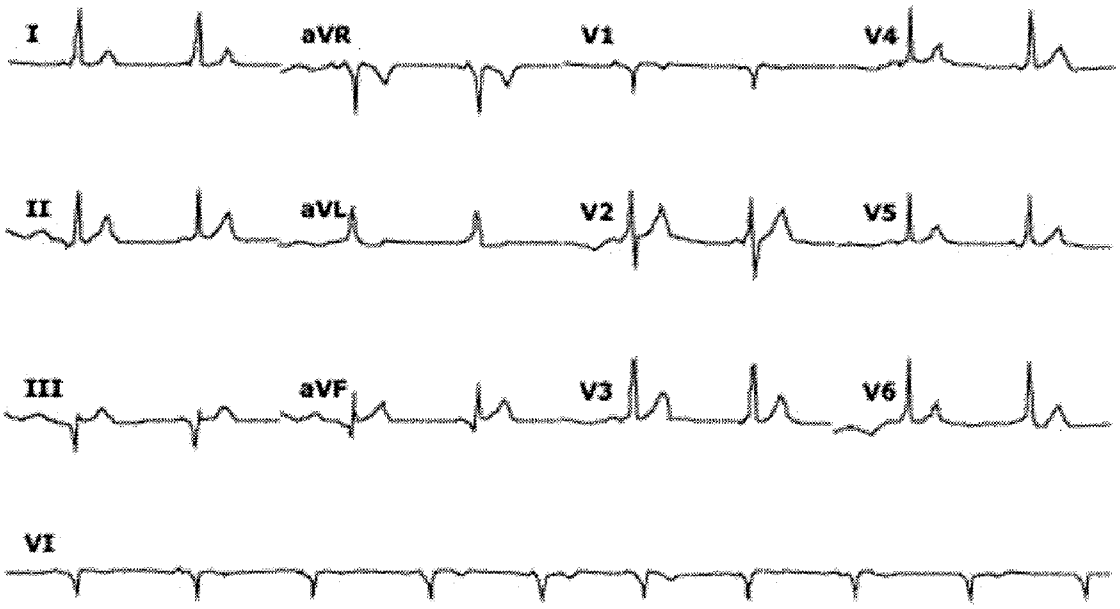


Right posteroseptal accessory pathway



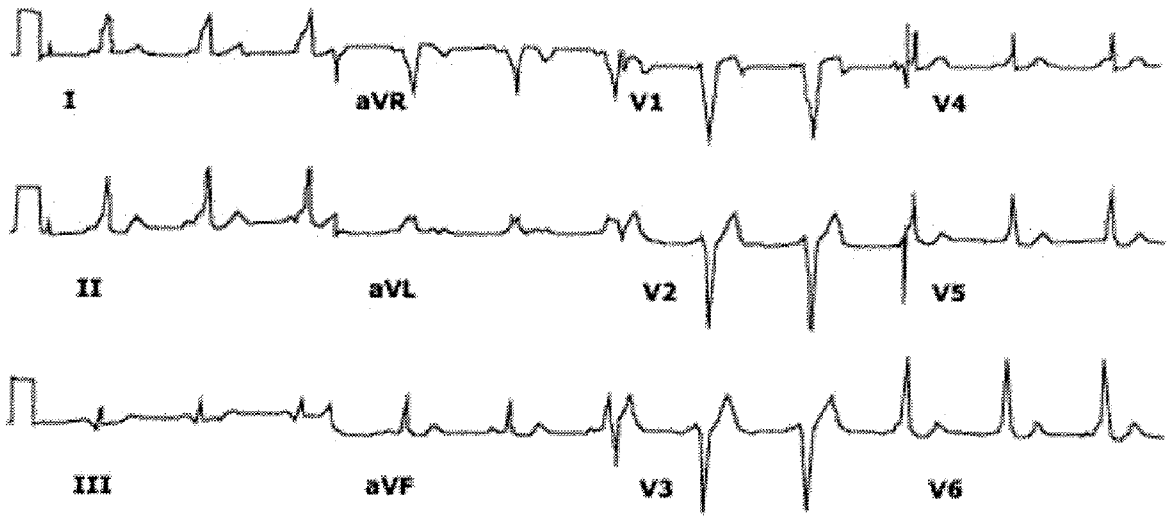
The QRS complex is maximally excited; the PR interval is short, and there is a left bundle branch morphology, left axis deviation, and early transition across the anterior precordial leads. The delta waves are positive in the lateral leads I, aVL, and V6 and negative in the inferior leads, localizing the pathway to the posteroseptal region. The negative delta wave in lead II places the pathway on the right, in the area between the coronary sinus os and middle cardiac vein.

Right posteroseptal accessory AV pathway



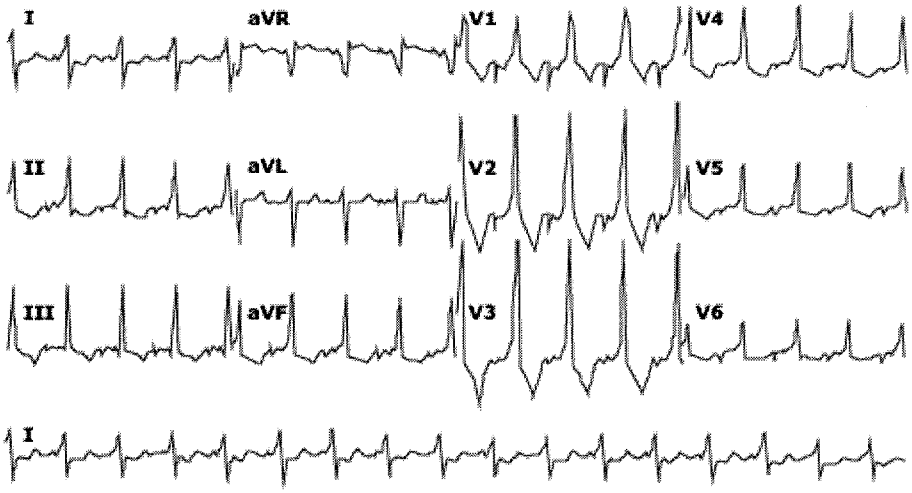
There is early transition across the precordial leads, with R/S ratio of 1 occurring in lead V2. The delta waves are positive in the lateral leads I, aVL, and V6, and negative in leads III and aVF, localizing the pathway to the posteroseptal area. The positive delta wave in lead II and in the lateral leads localize the pathway to the right side.

Right lateral accessory AV pathway



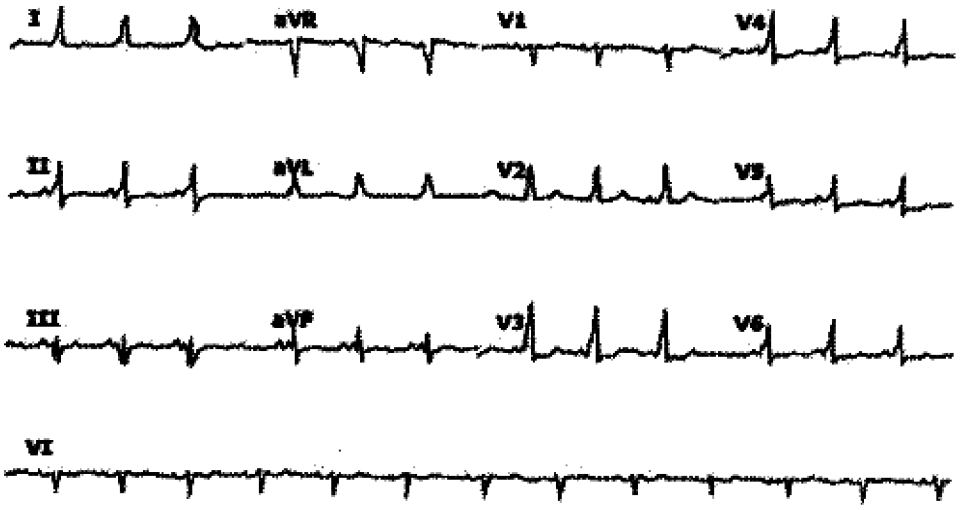
ECG in sinus rhythm shows classic preexcitation with a short PR interval, delta wave, and widened QRS complex with a left bundle branch block morphology. The delta wave is positive in the lateral leads 1, aVL, and V6, it is negative in lead III and isoelectric in lead aVF. The QRS axis of <30L distinguishes this pathway from an anteroseptal accessory AV pathway.

Left anterior lateral accessory pathway



QRS complexes that are maximally preexcited. The PR interval is short, there is a right bundle branch morphology, and the axis is rightward. The delta wave is positive in the lateral leads I, avL, and V6, localizing the pathway to the left anterior lateral region.

Midseptal accessory AV pathway



The ECG criteria for a midseptal pathway are intermediate between those for posteroseptal and anteroseptal connections within the triangle of Koch. These pathways have been difficult to predict from the surface ECG and have usually been grouped as septal pathways. The ECG shows positive delta waves in the lateral leads I, aVL, and V6, with early transition and a tall R wave in lead V2. The delta wave is positive in leads II and aVF and negative in lead III, and the QRS axis is <0°, localizing the pathway in the midseptum.

Reference

1. Arruda MS, McClelland JH, Wang X, et al. Development and validation of an ECG algorithm for identifying accessory pathway ablation site in Wolff-Parkinson-White syndrome. J Cardiovasc Electrophysiol 1998; 9:2.